A/ Re-issue

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PTO/SB/50 (4/98)
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REISSUE PATENT APPLICATION TRANSMITTAL

Address to:

Commissioner for Patents
Box Patent Application
Washington, DC 20231

Attorney Docket No.	5167
First Named Inventor	Thomas J. Quinn
Original Patent Number	5,898,421
Original Patent Issue Date (Month/Day/Year)	April 27, 1999
Express Mail Label No.	EL566299460US

APPLICATION FOR REISSUE OF: (*check applicable box*) ☒ *Utility Patent* ☐ *Design Patent* ☐ *Plant Patent*

APPLICATION ELEMENTS

1. ☒ *Fee Transmittal Form ((PTO/SB/56) (Submit an original, and a duplicate for fee processing)*
2. ☒ Specification and Claims (*amended, if appropriate)*
3. ☐ Drawing(s) (*proposed amendments, if appropriate)*
4. ☒ Reissue Oath/Declaration (original or copy) (*37 C.F.R. § 1.175)(PTO/SB/51 or 52)*
5. Original U.S. Patent
   - ☒ Offer to Surrender Original Patent (*37 C.F.R. § 1.178) (PTO/SB/53 or PTO/SB/54)*
   - *or*
   - ☐ Ribboned Original Patent Grant
   - ☐ Affidavit/Declaration of Loss *(PTO/SB/55)*
6. Original U.S. Patent currently assigned?
   - ☒ Yes ☐ No

(If Yes, check applicable box(es))

- ☒ Written Consent of all Assignees *(PTO/SB/53 or 54)*
- ☒ 37 C.F.R. § 3.73(b) Statement ☐ Power of Attorney

ACCOMPANYING APPLICATION PARTS

7. ☐ Foreign Priority Claim (*35 U.S.C. 119) (if applicable*)
8. ☒ Information Disclosure Statement (IDS)/PTO-1449 ☒ Copies of IDS Citations
9. ☐ English Translation of Reissue Oath/Declaration (*if applicable*)
10. ☐ *Small Entity Statement(s) *(PTO/SB/09-12)* ☐ Statement filed in prior application, Status still proper and desired
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard *(MPEP 503) (Should be specifically itemized)*
13. ☒ Other: Recordation Cover Sheet and Assignment Request to Transfer Drawings

***NOTE FOR ITEMS 1 & 10:** IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).*

14. CORRESPONDENCE ADDRESS

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Signature	A. C. Smith	Date	8/17/2000

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UNITED STATES PATENT AND TRADEMARK OFFICE

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WASHINGTON, D.C. 20231
www.uspto.gov

APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/642,250	08/17/2000	Thomas J. Quinn	5167

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Palo Alto, CA 94306

FORMALITIES LETTER

OC000000005391826

Date Mailed: 09/12/2000

NOTICE OF INCOMPLETE REISSUE APPLICATION

FILED UNDER 37 CFR 1.53(b)

A filing date has NOT been accorded to the above identified application papers for the reason(s) indicated below.

All of the items noted below **and a newly executed oath or declaration covering the items must** be submitted within **TWO MONTHS** of the date of this Notice, unless otherwise indicated, or proceedings on the application will be terminated *(37 CFR 1.53(e))*.

The filing date will be the date of receipt of all items required below, unless otherwise indicated. Any assertions that the item(s) required below were submitted, or are not necessary for a filing date, must be by way of petition directed to the attention of the Office of Petitions accompanied by the $130.00 petition fee *(37 CFR 1.17(i))*. If the petition states that the application is entitled to a filing date, a request for a refund of the petition fee may be included in the petition.

- The application was deposited without drawings. 35 U.S.C. 113 (first sentence) requires a drawing "where necessary for the understanding of the subject matter sought to be patented." *Applicant should reconsider whether the drawings are necessary under 35 U.S.C. 113 (first sentence).*

A copy of this notice MUST be returned with the reply.

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE

PTO/SB/ 10 (6-95) (modified)
Approved for use through 07/31/96. OMB 0651-0031
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(c))--SMALL BUSINESS CONCERN	Docket Number (Optional): 5167

Applicant or Patentee: Thomas J. Quinn

Application or Patent No.: 09/642,250

Filing Date or Issue Date: August 17, 2000

Title: Gyroscopic Pointer and Method

I hereby declare that I am

[ ] the owner of the small business concern identified below:

[X]an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN Gyration

ADDRESS OF SMALL BUSINESS CONCERN 12930 Saratoga Avenue, Building C, Saratoga, CA 95070

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

[ ] the specification filed herewith with title as listed above.

[X] the application identified above.

[ ] the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention must file separate verified statements averring to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each such person, concern or organization having any rights in the invention is listed below:

[X] No such person, concern, or organization exists.

[ ] Each such person, concern or organization is listed below:

_____

_____

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING THOMAS J. QUINN

TITLE OF PERSON IF OTHER THAN OWNER CEO

ADDRESS OF PERSON SIGNING 12930 SARATOGA AVE, SARATOGA CA 95037

SIGNATURE _____ DATE 9/28/00

18388/0516
7/DOCS/10
96481.1

IN THE UNITED STATES

PATENT AND TRADEMARK OFFICE

PATENTEE:	Thomas J. Quinn
PATENT NO.:	5,898,421
ISSUED:	April 27, 1999
TITLE:	GYROSCOPIC POINTER AND METHOD
SERIAL NO.:	08/643,991
FILING DATE:	May 7, 1996
ATTY. DKT. NO.:	5167

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

REQUEST TO TRANSFER DRAWINGS

Sir:

Please transfer all drawings from the original Patent No. 5,898,421 to this Reissue Application.

Respectfully submitted,
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ACS/ah

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GYROSCOPIC POINTER AND METHOD

This is a continuation of application Ser. No. 08/406,727, filed on Mar. 20, 1995, now abandoned, which is a continuation of Ser. No. 08/000,651, filed on Jan. 5, 1993, now U.S. Pat. No. 5,440,326, which is a continuation of Ser. No. 07/497,127, filed on Mar. 21, 1990, now abandoned.

BACKGROUND OF THE INVENTION

1. Field

The present invention relates to the field of hand-held computer controllers. More specifically, the present invention relates to a hand-held gyroscopic pointer adapted for use as a cursor-control device for a computer.

2. Art Background

A. Computer controllers:

Historically, computer instructions have taken the form of commands entered as words on a keyboard. More recently, pointing devices and icon-based interface techniques have been developed which permit a computer user to select tasks and to enter commands by moving a cursor on a computer display screen in response to movement of a pointing device. Pointing devices used for this task have included joysticks, trackballs and mouse controllers. One early use of a mouse as a pointing device for an icon-based computer interlace was at Xerox PARC. More recently, the mouse has become well known as a computer input device with its use on the Apple Macintosh line of computers and on the workstation computers distributed by Sun Microsystem.

However, a mouse, requires a relatively large and flat 2-dimensional surface on which to move. Typically, this surface must be unobstructed and dedicated to mouse movement and measure over 9"×9". As a result, Other controllers, such as the trackball and joystick, are often used when flat surfaces are unavailable, as in the case of portable computers. However, trackballs and joysticks are constrained to use on a surface for practical applications.

Further, trackballs, joysticks, keys and mice are not mobile in free space nor do they provide three-dimensional output. One controller which is mobil in space is taught by Ronald E. Milner in this U.S. Pat. No. 4,862,152, "Sonic Positioning Device," issued Jan. 25, 1990. This device senses the position of a controller device in three dimensions by sensing the position of an ultrasonic transmitter relative to an array of receivers. However this device is not a true pointing device as it senses position rather than a vector from the device. Since the controller must be repositioned in space, rather than simply reoriented, relatively large hand movements are required to define cursor movements. Another controller mobil in free space, the Mattel Power Glove video game controller, incorporates two ultrasonic transmitters in a single controller and thus can determine a position as web as define a "pointing" vector through the two transmitters. However, both of these ultrasonic controllers are based on ranging techniques and thus have range and resolution limitations. Specifically, both must be used in conjunction with an array of receivers to determine the exact position of the controllers. This results in reduced accuracy as the controller is moved to a position more distant from the receivers. Further, these controllers are only use able in an active volume of space defined by those receivers. Further still, both are limited to use in relatively noise-free environments.

B. Gyroscopes:

Attitude indicators in aircraft, known as artificial horizons, use two-degree-of-freedom gyroscopes for inertia

space reference and the measurement of pitch and roll relative to the gravitational vector. The gravity vector is approximated by a pendulous device (suspended weight) which indicates the apparent vertical, that is, the combined effect of gravity and acceleration. Such a device, as described in *Gyroscopic Theory Design, and Instrumentation*, 1980, Wrigley, Hollister and Denhard, The M.I.T. Press, Cambridge, Mass., does not correctly indicate the true direction of gravity at any instant because of vehicle accelerations. However, the average direction of the apparent vertical over a period of several minutes approximates the direction of gravity well enough to provide an attitude reference. Gyroscopes thus provide a known technique for measuring roll and pitch relative to a gravity vector. However, gyroscopes are typically heavy and expensive and have not been successfully adapted to practical use as a handheld pointing devices for cursor control in computers.

Accordingly, it is desirable to provide a hand-held computer control device which has a long range and high resolution. Further, the controller should not be constrained to use on a flat surface or within a confined space. Further, it is desirable to have a controller which responds to a vector defined by the controller, i.e. responds to "pointing" of the controller, as opposed to merely detecting the position of the controller. It is desirable to have a controller which is self-contained and not subject to interference form outside sources of noise or subject to reduced accuracy as it is moved distant from an array of receivers. Further, it is desirable to provide a controller that produces three-dimensional output.

SUMMARY OF THE INVENTION

The present invention comprises a hand-held gyroscope adapted for use as a cursor control device for a computer. A motor at the core of the gyroscope is suspended by two pairs of orthogonal gimbals from a hand-held controller device which provide two-degrees-of-freedom for the gyroscope. The spin axis of the motor is norminally oriented vertically by a pendulous device. Electro-optical shaft angle encoders sense the rotation of a hand held controller device about the gyroscope as it is manipulated by a user and the resulting electrical output is converted into a format usable by a computer to control the x-y movement of a cursor on a two dimensional display screen of a computer display. The controller thus responds to angular movements of a user's hand, which permits relatively large and accurate movements of a cursor to be accurately defined without requiring correspondingly large and tiring hand movements. Further, the controller is self-contained and is thus not subject to sources of outside noise or constrained to use within any active volume. For additional ease of use, the bottom of the controller is rounded so that the controller can be reoriented or "pointed" while sitting on a surface

The resulting controller device is thus responsive to a vector defined by the controller, i.e. the "pointing" of the controller, as opposed to merely detecting its position, and can be used either in free space or while sitting on a surface. Unlike a classical pointing device such as a stick or a flashlight, it does not require both position and vector information to "point" to another fixed position. Rather, the vector information (i.e. "pitch" and "roll") is transformed directly into the "x" and "y" coordinates of a cursor position on a computer display. Further, by including a second gyroscope in the controller with the spin axis of the second gyroscope orthogonal to the first, "yaw" information, i.e. the angle of rotation of the controller about the spin axis of the first gyroscope, can be measured. This angle is transformed

directly into the "z" information, and used to control rotation of objects or to otherwise alter the computer display, such as by making an object appear closer or further away, in response to"z" axis information. This controller is highly accurate as the result of using electro-optic shaft angle encoders, and not limited to use on a flat surface or an active volume. It allows the input of three dimensional input, in the form of "pitch," "roll," and "yaw" angles, which are transformed into "x," "y," and"z" coordinates for input to a computer for the control of the cursor location and screen display. Further, since it is self contained, it is not subject to ambient noise, such as is the case with ultrasonic controllers.

These and other advantages and features of the invention will become readily apparent to those skilled in the art after reading the following detailed description of the invention and studying the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1** and **1A** are an expanded perspective view of one embodiment of the preferred invention.

FIG. **2** is an expanded perspective view of inner gimbal **115** and bearing **122**.

FIG. **3** is an illustration of the optical pattern on inner module **110**, the optical pattern on gimbal frame **135**, and the elements of shaft angle encoder sensing optics **165**.

FIG. **4** is an illustration of a quad photodiode.

FIG. **5** is an illustration of the preferred embodiment of a gyroscopic pointing device **500** coupled to a computer and computer display **505**.

FIG. **6** is a top view of an alternative embodiment of the present invention.

FIG. **7** is a top perspective view of the embodiment of FIG. **6**.

FIG. **8** is a perspective illustrator of a directional gyroscope used to provide three-dimensional output in the embodiment of FIGS. **6** and **7**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** is an expanded perspective view of one embodiment of the present invention. A brushless D.C. motor **105** at the core of the gyroscope spins continuously, providing the angular momentum that stabilizes the inner part of the gyroscope. Brushless D.C. Motors **105** is a motor such as used in miniature cooling fans distributed by U.S. TOYO Fan Corporation. Brushless D.C. Motors **105** is illustrated in the vertical cross section A—A of FIG. **1**, and is firmly mounted to inner module **110** with motor shaft **108** aligned orthogonally with respect to the axis of rotation of inner module **110** about inner gimbals **115** and **120**. Inner module **110** consists of injection molded plastic and two conductive inner gimbals gimbal **115** and gimbal **120**. Inner gimbals **115** and **120** are located on and aligned with the axis of rotation of inner module **110**. Further, inner gimbals **115** and **120** are electrically coupled to motor **105**. The center of mass of inner module **110**, which includes motor **105**, is slightly displaced along the axis of rotation of motor shaft **108** below the axis of rotation of inner module **110**. This results in a pendulous affect which causes motor shaft **108** to generally align with the gravity vector.

Inner gimbals **115** and **120** mechanically support inner module **110** and also provide an electrical path for the transmission of power from the gimbals to motor **105** without restricting the travel of inner module **110**. Two bearings support the inner gimbals relative to gimbal frame

135. Specifically, bearing 122 is mounted within bearing alignment hole 125 of gimbal frame 135 and supports inner gimbal 115. Similarly, bearing 124 is mounted within bearing alignment hole 130 of gimbal frame 135 and supports inner gimbal 120. Gimbal frame 135 includes two conductive outer gimbals 140 and 145. Two bearings support the outer gimbals relative to shock frame 160. Specifically, bearing 146 is mounted within bearing alignment hole 150 of shock frame 160 and supports outer gimbal 140. Similarly, bearing 147 is mounted within bearing alignment hole 155 of shock frame 160 and supports outer gimbal 145. Outer gimbal 140 is electrically coupled to inner gimbal 115. Similarly, outer gimbal 145 is electrically coupled to inner gimbal 120. This completes the electrical path from the non-rotating shock frame 160 to motor 105 within inner module 110.

Shock frame 160 is mounted with shock absorbing rubber to outer housing 175, which consists of two halves. This shock mounting prevents damage to the bearings or optical sensors in the event that the gyroscope is dropped, and permits the inner assemblies to be constructed with finer tolerances than would be possible without the shock mounting. Shaft angle encoder sensing optics 165, discussed in more detail below, are mounted on shock frame 160.

Outer housing 175 is opaque so as to prevent outside light from interfering with the optical sensing system and is adapted for hand holding as described more fully below with reference to FIGS. 5 and 6.

Cabling 180 transmits power from an interlace box 185 to outer housing 175 and returns data signals from shaft angle encoder sensing optics 165. In the preferred embodiment interface box 185 translates signals from the optical sensing system 165 into serial data for an RS-232 port. Wall adapter 190 provides D.C. power for motor 105 and shalt angle encoder sensing optics 165.

The construction details of the inner and outer gimbals is shown in further detail in FIG. 2. FIG. 2 is an expanded perspective view of inner gimbal 115 and bearing 122. Inner gimbal 115 includes a circular plug 205 which fits within the inner race of bearing 122. A conductive pin 210, having a diameter smaller than that of plug 205, is mounted concentrically with plug 205 and electrically coupled to motor 205. Pin 210 is preferably made of a low-friction conductive material such as carbon-teflon and designed to protrude from the inner race of bearing 122. The diameter of pin 210 is smaller than the diameter of the inner race so as not contact the inner race and to minimize the friction of the rotating contact. A stainless steel spring 215 is mounted to gimbal frame 135 and aligned with and in electrical contact with protruding surface 220 of pin 210. Spring 215 is electrically coupled to a D.C. power source through outer gimbal 140. Spring 215 presses against pin 210 providing a low friction electrical connection between gimbal frame 135 and inner module 110. Inner gimbal 120 and outer gimbals 140 and 145 are constructed in an identical manner.

Inner module 110 has a hemispherical outer surface with an optical pattern which interacts with shaft angle encoder sensing optics 165 to sense the rotation of inner module 110 around the axis of rotation through gimbals 115 and 120. This optical pattern is illustrated in FIG. 3. The optical pattern on inner module 110 is constructed by first painting the hemispherical surface with a highly reflective aluminum flaked paint and then machining grooves of 0.015 inch depth and width along "lines of longitude" from gimbal 115 towards gimbal 120 along the surface. The grooves are machined to within 30 degrees of each inner gimbal and are

0.015 inches apart at 30 degrees from each gimbal. The pattern causes the spacing between the groove centerlines to widen to approximately 0.04 inches at the middle ("equator") of inner module **110**. Inner module **110** is molded from a non-reflective black plastic. Thus the grooved portions of inner module **110**. where the reflective paint has been machined off. are non-reflective. This provides a precise optical pattern on inner module **110** having a relatively high contrast ratio.

And second optical pattern is machined into gimbal frame **135** along a cylindrical section **170** of gimbal frame **135**. This pattern interacts with shalt angle encoder sensing optics **165** for sensing rotation of gimbal frame **135** around its axis of rotation through gimbals **140** and **145**. This cylindrical section is geometrically centered about the axis of rotation of gimbal frame **135**. which passes through gimbals **140** and **145**. As with the optical pattern on the inner module **110**. the optical pattern on gimbal frame **135** is constructed by applying reflective paint to cylindrical section **170** and then machining grooves of 0.015 inch depth and width on the surface of the cylinder.

These grooves are machined along lines parallel to the axis of rotation of gimbal frame **135** and evenly spaced so that the light and dark strips are of equal width. Cylindrical section **170** is displaced slightly from the center of gimbal frame **135** so as not lo interfere with the interaction of shaft angle encoder sensing optics **165** and the optical pattern on inner module **110**. Specifically. the closest edge of cylindrical section **170** is spaced approximately 0.15 inches away from the "equator" of frame **170** passing through inner gimbals **115** and **120**.

Shaft angle encoder sensing optics **165** interact with the optical pattern on inner module **110** so as to determine the rotation of the inner module **110** about its axis of rotation. More specifically. shaft angle encoder sensing optic **165** include sources for illuminating the patterns. lenses for focusing images of the patterns. and photodetectors for detect a dark or light areas. Referring to FIG. **3**. a first LED **305** is mounted to shock frame **160** at an angle of 30 degrees from vertical in a plane parallel to the axis through gimbals **140** and **145** so as to floodlight an area **310** of the optical pattern on inner module **110**. This area is centered on the "equator" of frame **135** so as to provide maximum range of detectable movement in both directions. Lens **315** and mirror **320** focus and reflect the image of the illuminated optical pattern onto quad photodiode **325**. Lens **315** is an injection molded lens of approximately ⅛ inch in diameter having a focal length of approximately 0.2 inches.

Quad photodiode **325** comprises four photodiodes, **402**. **404**. **406** and **408**. located in a row as illustrated in FIG. **4**. The sides of quad photodiode **325** are aligned with the edges of the projected image of the optical pattern on inner module **110**. One period of the projected image of the optical pattern on inner module **110** (one light and one dark bar) nominally covers the quad photodiode **325**. which comprise four photodiodes centered 0.02 inches apart. Photodiodes **402** and **406** are counted to comparator **420**. Photodiodes **404** and **408** are coupled to comparator **410**. The output V1 of comparator **410** is thus in phase quadrature with the output V2 of comparator **420**. These outputs are then detected by conventional means to determine the rotation of the inner module. An example of phase quadrature resolution is provided in U.S. Pat. No. 4.346.989 titled Surveying Instrument. issued to Alfred F. Gori and Charles E. Moore Aug. 31. 1982 and assigned to the Hewlett-Packard Company. A prototype of this embodiment of the present invention results in a resolution of approximately 100 counts per inch.

Shaft angle encoder sensing optics **165** also interacts with the optical pattern on gimbal frame **160** so as to determine the rotation of gimbal frame **135** about its axis of rotation. More specfically, a second sensing system, similar to the one described but oriented 90 degrees with respect to the first, is positioned on frame **160** so as to interact with the optical pattern on frame **135** and to detect rotation of frame **135** about its axis of rotation. Referring again to FIG. **3**, a second LED **330** is mounted to shock frame **160** at an angle of 30 degrees from vertical in a plane parallel to the axis through gimbals **115** and **120** in alignment with cylindrical section **170** so as to floodlight an area **335** of the optical pattern on cylindrical section **170**. Lens **340** and mirror **320** focus and reflect the image of the illuminated optical pattern onto quad photodiode **345**. Lens **340** is an injection molded lens of approximately ⅛ inch in diameter having a focal length of approximately 0.2 inches.

Quad photodiode **345** comprises four photodiodes located in a row and is identical in construction to quad photodiode **325** illustrated in FIG. **4**. The sides of quad photodiode **345** are aligned with the edges of the projected image of the optical pattern on gimbal frame **135**. FIG. **5** is an illustration of the preferred embodiment of a gyroscopic pointing device **500** coupled to a computer **502** and computer display **505**. Computer **502** is adapted so that changing the pitch of controller **500** relative to the gravity vector charges the vertical position of cursor **510** on computer display **505**. That is, rotating the controller forward ("pitch") causes the cursor to drop on a vertical computer screen, rotating it back causes the cursor to rise, as if the controller was pointing at the cursor. Similarly, rotating the controller from side to side ("roll") changes the horizontal position of cursor **510** on computer display **505**. That is, rotating the controller left causes the cursor to move left on a vertical computer screen, rotating it right causes the cursor to move to the right, again, as it the controller was pointing at the cursor. Controller **500** further includes a thumb operated push button **520** and has a rounded hemispherically shaped bottom portion **525** adapted for smoothly rocking on a flat surface when the pitch and roll of controller **500** is varied while resting on a flat surface. This can be a two position switch, where initial pressure on the switch activates the controller and causes the cursor to move in response to the controller, and a second position of the switch results in a"pick" or "select" signal being transmitted to the computer.

FIG. **6** is a top view of an alternative embodiment of the present invention. FIG. **7** is a top perspective view of the same embodiment. Specifically, FIGS. **6** and **7** illustrate a controller shaped so as to be hand held in a manner such that the palm will be facing down while controller **610** is resting on a flat surface. The under side of controller **610** is rounded to facilitate changes of its orientation with respect to vertical. A palm button **620** is actuated when the controller is grasped, thus permitting the controller to be deactivated, moved or reoriented, then reactivated. A pick button **630** is located for selective activation by a users lingers in a manner similar to the use of a pick button on a mouse controller.

The embodiment of FIGS. **6** and **7** includes a first gyroscope as discussed with regards to FIGS. **1–4** for the measurement of pitch and roll. Further, it includes a second gyroscope, as illustrated in FIG. **8**, for measurement of yaw about the vertical axis. Specifically, a rotating gyroscopic element **810** is mounted in a two-degree-of freedom gimbal system with its spin axis **820** in a horizontal direction. In the preferred embodiment a mass gives the gyroscope a pendulosity at right angles to spin axis **820**. More specifically, gyroscope **810** is mounted to inner frame **815**. Inner frame

815 is mounted to gimbal frame 825 by inner gimbals 845. Gimbal frame 825 is mounted to an outer housing 860 by gimbal 850. A shaft angle encoder 870 is coupled to detect the rotation of gimbal frame 825 relative to outer housing 860. Oscillations are damped out by applying an antipendulous torque caused by liquid flow of a viscous fluid through a constriction in a tube, as in damper 840. Computer 502 is further adapted to convert the angle measured by shaft angle encoder 870. This conversion could be to rotation of the cursor or a cursor-selected object or for providing a "z" input for a three dimensional display or a two-dimensional display simulating a three dimensional view.

While the invention has been particularly taught and described with reference to the preferred embodiment, those versed in the art rill appreciate that minor modifications in form and detail may be made without departing from the spirit and scope of the invention. For instance, although the illustrated embodiment teaches one system of shaft angle encoders, many alternative systems could be used for detecting the orientation of the gyroscopic controller. Further, while the preferred embodiment leaches a vertically oriented gyroscope and detection of two angles from vertical such as in an artificial horizon instrument. Other gyroscopic orientations, such as those used for directional gyroscopes, could be substituted. Further, while the present invention teaches the detection of two angles from a vertically oriented gyroscope and one angle from a horizontally oriented gyroscope, two angles could be detected from the horizontal gyroscope and one from the vertical gyroscope. Further, many techniques equivalent techniques to the pendulous are known for orienting gyroscopes. Accordingly, all such modifications are embodied within the scope of this patent as properly come within our contribution to the art and are particularly pointed out by the following claims.

IN THE UNITED STATES

PATENT AND TRADEMARK OFFICE

APPLICANT: Thomas J. Quinn

REISSUE

APPLICATION NO.: 09/642,250

FILING DATE: August 17, 2000

TITLE: GYROSCOPIC POINTER AND METHOD

EXAMINER: Unassigned

GROUP ART UNIT: Unassigned

ATTY. DKT. NO.: 5167

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Dated: 10/5/2000 By: A. C. Smith

Albert C. Smith, Reg. No.: 20,355

COMMISSIONER FOR PATENTS
WASHINGTON, DC. 20231

LETTER TO THE CHIEF DRAFTSMAN

SIR:

Applicant respectfully requests that the attached six (6) sheets of formal drawings be made part of the subject reissue application.

Respectfully submitted,
THOMAS J. QUINN

Dated: 10/5/2000 By: A. C. Smith

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I claim:

1. (Amended) A method for effecting movements of [moving] a [displayed] displayable object on [an interactive] a computer graphic display having vertical and horizontal Cartesian coordinate axes in response to one of pitch and yaw rotations of an input device, the method comprising: [the steps of:]

[detecting the pitch or yaw rotation of the device;]

sensing an inertial response to pitch or yaw rotation of the input device to produce [provide] a signal [indicative of] proportional to the at least one of the pitch and yaw rotations of the input device; and

[in response to the signal indicating the detected pitch or yaw movement of the input device,] moving the [displayed] displayable object a distance in a plane defined by the vertical and horizontal axes on the computer graphic display in substantially continuous proportionality to the signal and [,the displayed object being moved] translationally along one of the vertical and horizontal axes in substantially a single direction for each direction in which the input device is rotated.

2. (Amended) [A] The method according to [for effecting translational movements of a displayed object on an interactive computer graphic display as in] claim 1 further comprising: [the steps of:]

selectively inhibiting the input device from producing [a] the signal to permit reorientation of the input device without substantially proportional translational movement of the displayed object on the computer graphic display; and

selectively enabling the input device for producing the signal in response to said one of pitch and yaw rotations of the input device.

3. (Amended) A method for [providing a signal to effect] effecting translational movements of a [displayed] displayable object on [an interactive] a computer graphic display using an input device including an inertial gyroscopic element that is manually movable in free space, the method comprising: [the steps of:]

supporting the inertial gyroscopic element with respect to the input device;

actuating the gyroscopic element to exhibit inertia relative to an inertial axis;

detecting rotational movement of the input device relative to the inertial axis of the gyroscopic element; and

[providing] producing a signal [responsive] substantially proportional to the rotation of the input device relative to the inertial axis for effecting translational movements of the [displayed] displayable object on the computer graphic display in substantially continuous proportionality to the signal and in a single direction for each direction in which the input device is rotated.

4. (Amended) A method for effecting [providing a signal to effect] translational movements of a [displayed] displayable object on [an interactive] a computer graphic display using an inertial input device that is manually movable in free space, the method comprising: [the steps of:]

detecting[, by inertial means,] rotational movement of the input device about one axis; and

[providing] producing a first signal substantially proportional [responsive] to the rotation of the input device about the one axis for effecting translational movements of the [displayed] displayable object on the computer graphic display in substantially continuous proportionality to the first signal and in a single direction for each direction in which the input device is rotated.

5. (Amended) [A] The method according to claim 4 for [providing signals to effect] effecting the translational movements on [an interactive] the computer graphic display along at least one of first and second coordinate axes[,] using the inertial input device, the method further comprising: [the steps of:]

detecting[, by inertial means,] rotational movement of the input device about a second axis not parallel to the one axis;

[providing] producing a second signal [responsive] substantially proportional to the rotation of the input device about the second axis[; and] for effecting translational movements [on the display] of the displayable object along a first coordinate axis of the computer graphic display in substantially continuous proportionality [response] to the first signal and in a single direction for each direction in which the input device is rotated about the one axis, or along a second coordinate axis of the computer graphic display in [response] substantially continuous proportionality to the second signal and in a single direction for each direction in which the input device is rotated about the second axis.

6. (Amended) [A graphical] An input device for providing a signal to effect translational movements of a [displayed] displayable object on [an interactive] a computer graphic display, comprising:

a hand-held housing adapted for manual movement in free space; and

an inertial gyroscopic element mounted with respect to said housing[, for providing a signal, in response] and responsive to rotation of the housing about an axis for producing a signal substantially proportional to said rotation for effecting[, to effect] translational movements of the [displayed] displayable object on [an interactive] the computer graphic display in substantially continuous proportionality to the signal and in a single direction for each direction in which the [device] housing is rotated.

7. (Amended) [A graphical] The input device [for providing a signal to effect translational movements of a displayed object on an interactive computer graphic display as in] according to claim 6[,] wherein the gyroscopic element comprises an angular position gyroscope.

8. (Amended) [A graphical] The input device [for providing a signal to effect translational movement of a displayed object on an interactive computer graphic display as in] according to claim 7[,] wherein the angular position gyroscope comprises:

an inertial gyroscopic element disposed to spin about a spin axis;

a gimbal supporting the gyroscopic element with respect to the housing; and

a sensor disposed with respect to the gimbal and the housing for producing said signal in response to rotation of the housing relative to the spin axis.

9. A graphical input device for providing a signal to effect the translational movement of a cursor on an interactive computer graphic display comprising:

a housing adapted for manual movement in free space;

an inertial gyroscopic element disposed to spin about one spin axis;

a gimbal supporting the gyroscopic element with respect to the housing; and

a sensor disposed with respect to the gimbal and the housing for producing a signal, in response to rotation of the housing relative to one spin axis, to effect translational movement of the cursor in substantially a single direction for each direction in which the housing is rotated.

10. A graphical input device for providing a signal to effect the translational movement of a cursor on an interactive computer graphic display as in claim 9 further comprising a manually operable switch mounted with respect to the housing and operatively connected for selecting inhibiting the graphical input device from producing a signal to permit reorientation of the graphical input device without translational movement of the cursor in response to said signal, and for selectively enabling the graphical input device for producing said signal in response to rotational movement of the housing relative to the spin axis of the gyroscopic element.

11. A graphical input device for providing signals to effect translational movement of a cursor on an interactive computer graphic display as in claim 10 wherein the signal is produced in response to one of pitch and yaw rotational movement of the housing for effecting the translational movement of the cursor along one of vertical and horizontal Cartesian coordinate axes of the display in response to the signal.

12. An interactive computer graphic display system comprising a graphical input device as in claim 11 and further comprising a circuit coupled to the display for effecting the translational movement of the cursor along one of the horizontal and vertical Cartesian coordinate axes of the display in response to the signal.

13. (Amended) A method for controlling translational movements of a [displayed] displayable object on [an interactive] a computer graphic display having vertical and horizontal Cartesian coordinate axes in response to one of pitch and yaw rotations of an input device, the method comprising: [the steps of:]

detecting the pitch or yaw rotation of the input device;

sensing an inertial response to [provide] produce a signal [indicative of] substantially proportional to at least one of the pitch and yaw rotations of the input device; and

in response to the signal, [detecting pitch or yaw movement of the input device,] moving the [displayed] displayable object a substantially continuously proportional distance in a plane defined by the vertical and horizontal axes on the computer graphic display without rotating the [displayed] displayable object.

14. (Amended) [A graphical] An input device for providing a signal to manipulate translational movements of a [displayed] displayable object on [an] a computer graphic display, comprising:

a hand-held housing adapted for manual movement in free space; and

an inertial gyroscopic element mounted with respect to said housing[, for providing a signal, in response] and responsive to rotation of the housing about an axis for producing a signal substantially proportional to said rotation for manipulating [to manipulate] translational movements of the displayable [displayed] object on the [an interactive] computer graphic display in substantially continuous proportionality to the signal without causing the [displayed] displayable object to be rotated.

15. (Amended) A method for [providing] producing a signal to control translational movements of a displayable [displayed] object on [an interactive] a computer graphic display using an input device including an inertial gyroscopic element that is manually movable in free space, the method comprising: [the steps of:]

supporting the inertial gyroscopic element with respect to the input device;

actuating the gyroscopic element to exhibit inertia relative to an inertial axis;

detecting rotational movement of the input device relative to the inertial axis of the gyroscopic element; and

[providing] producing a signal substantially proportional [responsive] to the rotation of the input device relative to the inertial axis for controlling translational movements of the [displayed] displayable object in substantially continuous proportionality to the signal without causing the [displayed] displayable object to be rotated.

16. (New) An interactive computer graphic display system comprising an input device according to claim 6 and further comprising a circuit coupled to the computer graphic display for effecting the translational movement of a displayable object along one of horizontal and vertical

Cartesian coordinate axes of the computer graphic display in substantially continuous proportionality to the signal.

17. (New) A method for effecting movements of a displayable object on a graphic display having vertical and horizontal Cartesian coordinate axes in response to one of pitch and yaw rotations of an input device, the method comprising:

sensing gravitational orientation;

sensing an inertial response to pitch or yaw rotation of the input device relative to the gravitational orientation to produce a signal indicative of at least one of the pitch and yaw rotations of the input device relative to the gravitational orientation; and

moving the displayable object a distance in a plane defined by the vertical and horizontal axes on the computer graphic display translationally along one of the vertical and horizontal axes in substantially a single direction for each direction in which the input device is rotated.

18. (New) The method according to claim 17, further comprising:

selectively inhibiting the input device from producing the signal to permit reorientation of the input device without translational movement of the displayed object on the computer graphic display; and

selectively enabling the input device for producing the signal in response to said one of pitch or yaw rotations of the input device relative to the gravitational orientation.

19. (New) A method for effecting movements of a displayable object on a graphic display having vertical and horizontal Cartesian coordinate axes in response to one of pitch and yaw rotations of an input device including an inertial element, the method comprising:

sensing gravitational orientation;

sensing an inertial response to pitch or yaw rotation of the inertial element relative to the gravitational orientation to produce a signal indicative of at least one of the pitch and yaw rotations of the device relative to the gravitational orientation; and

moving the displayable object a distance in a plane defined by the vertical and horizontal axes on the computer graphic display translationally along one of the vertical and horizontal axes in substantially a single direction for each direction in which the input device is rotated.

20. (New) The method according to claim 19, further comprising:

selectively inhibiting the inertial element from producing the signal to permit reorientation of the input device without translational movement of the displayed object on the computer graphic display; and

selectively enabling the inertial element for producing the signal in response to said one of pitch or yaw rotations of the input device relative to the gravitational orientation.

21. (New) A method for effecting translational movements of a displayable object on a computer graphic display using an input device including an inertial gyroscopic element that is manually movable in free space, the method comprising:

supporting the inertial gyroscopic element with respect to the input device;

actuating the gyroscopic element to exhibit inertia relative to an inertial axis;

sensing gravitational orientation;

detecting rotational movement of the input device about the inertial axis of the gyroscopic element relative to the gravitational orientation; and

producing a signal responsive to the rotation of the input device about the inertial axis relative to the gravitational orientation for effecting translational movements of the displayable object on the computer graphic display in substantially a single direction for each direction in which the input device is rotated.

22. (New) A method for effecting translational movements of a displayable object on a computer graphic display using an inertial input device that is manually movable in free space, the method comprising;

sensing gravitational orientation;

detecting rotational movement of the input device about one axis relative to the gravitational orientation; and

producing a first signal substantially proportional to the rotation of the input device about the one axis for effecting translational movements of the displayable object on the computer graphic display in substantially continuous proportionality to the first signal and in a single direction for each direction in which the input device is rotated.

23. (New) The method according to claim 22 for effecting the translational movements on the computer graphic display along at least one of first and second coordinate axes using the inertial input device, the method further comprising:

detecting rotational movement of the input device about a second axis not parallel to the one axis and relative to the gravitational orientation;

producing a second signal responsive to the rotation of the input device about the second axis for effecting translational movements of the displayable object along a first coordinate axis of the computer graphic

display in substantially continuous proportionality to the first signal and in a single direction for each direction in which the input device is rotated about the one axis, or along a second coordinate axis of the computer graphic display in response to the second signal and in a single direction for each direction in which the input device is rotated about the second axis.

24. (New) An input device for producing a signal to effect translational movements of a displayable object on a computer graphic display, comprising:

a hand-held housing adapted for manual movement in free space;

sensing apparatus in the housing to detect gravitational orientation; and

an inertial gyroscopic element mounted with respect to said housing and responsive to rotation of the housing about an axis relative to the gravitational orientation to produce a signal indicative of said rotation for effecting translational movements of the displayable object on the computer graphic display in substantially a single direction for each direction in which the housing is rotated.

25. (New) An input device according to claim 24, wherein the sensing apparatus detects substantially vertical gravitational orientation independent of the orientation of the housing in free space.

26. (New) The input device according to claim 25, wherein the sensing apparatus comprises:

an inertial gyroscopic element disposed to spin about a spin axis;

a gimbal supporting the gyroscopic element with respect to the housing and including a center of mass eccentric the spin axis; and

a sensor communicating with the gimbal for producing an output indicative of the gravitational orientation.

27. (New) An input device for producing a signal to effect translational movement of a displayable object on a graphic display, the input device comprising:

a hand-held housing adapted for manual movement in free space;

an inertial gyroscopic element disposed to spin about one spin axis;

a gimbal supporting the gyroscopic element with respect to the housing and including a center of mass eccentric the spin axis;

a first sensor disposed with respect to the gimbal and the housing and responsive to rotation of the housing relative to one spin axis for producing a signal substantially proportional to said rotation for effecting translational movement of the displayable object in substantially continuous proportionality to the signal and in a single direction for each direction in which the housing is rotated; and

a second sensor in communication with the gimbal for producing an output indicative of gravitational orientation, independent of the orientation of the housing in free space.

28. (New) An interactive computer graphic display system comprising an input device as in claim 24 and further comprising a circuit coupled to the display for effecting translational movement of the displayable object along one of horizontal and vertical Cartesian coordinate axes of the computer graphic display in response to the rotation of the housing relative to the gravitational orientation.

29. (New) An input device for manipulating translational movements of a displayable object on a computer graphic display, comprising:

a hand-held housing adapted for manual movement in free space;

sensing apparatus in the housing to detect gravitational orientation; and

an inertial element mounted with respect to said housing and responsive to rotation of the housing about an axis relative to gravitational orientation for producing a signal indicative of said rotation for manipulating translational movements of the displayable object on the computer graphic display without causing the displayable object to be rotated.

30. (New) A method for producing a signal to control translational movements of a displayable object on a computer display using an input device including an inertial element that is manually movable in free space, the method comprising:

supporting the inertial element with respect to the input device;

sensing gravitational orientation of the input device in free space;

sensing inertia of the input device relative to the sensed gravitational orientation;

detecting rotational movement of the input device with respect to an inertial axis of the inertial element relative to the gravitational orientation; and

producing a signal substantially proportional to the rotation of the input device about the inertial axis relative to the gravitational orientation for controlling translational movements of the displayable object in response to the signal without causing the displayable object to be rotated.

31. (New) The method according to claim 5 further comprising:

selectively inhibiting producing at least one of the first and second signals to permit reorientation of the device without translational movement of the displayable object on the computer display; and

selectively enabling producing the at least one of the first and second signals in response to rotational movement of the input device about the corresponding one and second axes.

32. (New) The input device according to claim 6 comprising:

a switch mounted on the housing for manual activation to one operating state for selectively inhibiting producing said signal, and for actuation to another operating state for enabling producing said signal in response to said rotation of the housing.

33. (New) An input device for producing a signal to manipulate translational movements of a displayable object on a computer graphic display, comprising:

a hand-held housing adapted for manual movement in free space;

an inertial element mounted with respect to the said housing and responsive to rotation of the housing with respect to an inertial axis of the inertial element for producing a signal indicative of said rotation for manipulating translational movements of the displayable object on the computer graphic display; and

a switch mounted on the housing for manual actuation to one operating state for selectively inhibiting producing said signal, and for

actuation to another operating state for enabling producing said signal in response to said rotation.

34. (New) The method according to claim 21 further comprising:

selectively inhibiting producing said signal to permit reorientation of the input device without translational movement of the displayable object on the computer graphic display; and

35. (New) The method according to claim 23 further comprising:

selectively inhibiting producing at least one of the first and second signals to permit reorientation of the input device without translational movement of the displayable object on the computer graphic display; and

selectively enabling producing at least the one of the first and second signals in response to said rotation of the input device about the corresponding one and second axes.

36. (New) The input device according to claim 24 comprising:

a switch mounted on said housing for manual actuation to one operating state for selectively inhibiting producing said signal, and for actuation to another operating state for enabling producing said signal in response to said rotation of the housing.

37. (New) The input device according to claim 29 comprising:

a switch mounted on said housing for manual actuation to one operating state for selectively inhibiting producing said signal, and for actuation to another operating state for enabling producing said signal in response to said rotation of the housing.

38. (New) The method according to claim 30, further comprising:

selectively inhibiting producing said signal to permit reorientation of the input device without translational movement of the displayable object on the computer graphic display; and

selectively enabling producing said signal in response to said rotation of the input device.

39. (New) An input device for producing a signal to effect translational movements of a displayable object on a computer graphic display, comprising:

an inertial gyroscopic means adapted for manual movement in free space for producing a signal substantially proportional to rotation of the housing about an axis to effect translational movements of the displayable object on the computer graphic display in substantially continuous proportionality to the signal and in a single direction for each direction in which the inertial gyroscopic means is rotated.

40. (Amended) [A graphical] The input device according to claim 39 wherein the inertial gyroscopic means comprises an angular position gyroscope.

41. (New) The input device according to claim 39 further comprising:

switch means mounted with respect to the inertial gyroscopic means for selectively inhibiting producing said signal to permit reorientation of the input device without translational movement of the displayable object in response to said signal, and for selectively enabling the input device to produce said signal.

42. (New) An interactive computer graphic display system comprising an input device as in claim 39 and further comprising circuit means for effecting translational movement of the displayable object along one of horizontal and vertical Cartesian coordinate axes of the computer graphic display in substantially continuous proportionality to the signal.

43. (New) An input device according to claim 39 comprising:

sensing means for detecting gravitational orientation; and

said inertial gyroscopic means produces said signal indicative of said rotation relative to the gravitational orientation.

44. (New) An interactive computer graphic display system comprising an input device as in claim 43 and further comprising circuit means for effecting translational movement of the displayable object along one of horizontal and vertical Cartesian coordinate axes of the computer graphic display in response to the rotation of the housing relative to the gravitational orientation.

45. (New) An input device for manipulating translational movements of a displayable object on a computer graphic display, comprising:

hand-held housing means adapted for manual movement in free space;

sensing means in the housing means for detecting gravitational orientation; and

inertial means mounted with respect to said housing means and responsive to rotation of the housing means about an axis relative to gravitational orientation for producing a signal indicative of said rotation for manipulating translational movements of the displayable object on the computer graphic display without causing the displayable object to be rotated.

46. (New) The input device according to claim 39 comprising:

switch means with the inertial gyroscopic means for manual activation to one operating state for selectively inhibiting producing said signal, and for actuation to another operating state for enabling producing said signal in response to said rotation of the housing.

47. (New) The input device according to claim 43 comprising:

switch means mounted with said sensing means and said inertial gyroscopic means for manual actuation to one operating state for selectively inhibiting producing said signal, and for actuation to another operating state for enabling producing said signal in response to said rotation.

48. (New) The input device according to claim 45 comprising:

switch means on said housing means for manual actuation to one operating state for selectively inhibiting producing said signal, and for actuation to another operating state for enabling producing said signal in response to said rotation of said housing means.

ABSTRACT

A vertical gyroscope is adapted for use as a pointing device for controlling the position of a cursor on the display of a computer. A motor at the core of the gyroscope is suspended by two pairs of orthogonal gimbals from a hand-held controller device and nominally oriented with its spin axis vertical by a pendulous device. Electro-optical shaft angle encoders sense the orientation of a hand-held controller device as it is manipulated by a user and the resulting electrical output is converted into a format usable by a computer to control the movement of a cursor on the screen of the computer display. For additional ease of use, the bottom of the controller is rounded so that the controller can be pointing while sitting on a surface. A third input is provided by providing a horizontal gyroscope within the pointing device. The third rotational signal can be used to either rotate a displayed object or to display or simulate a third dimension.

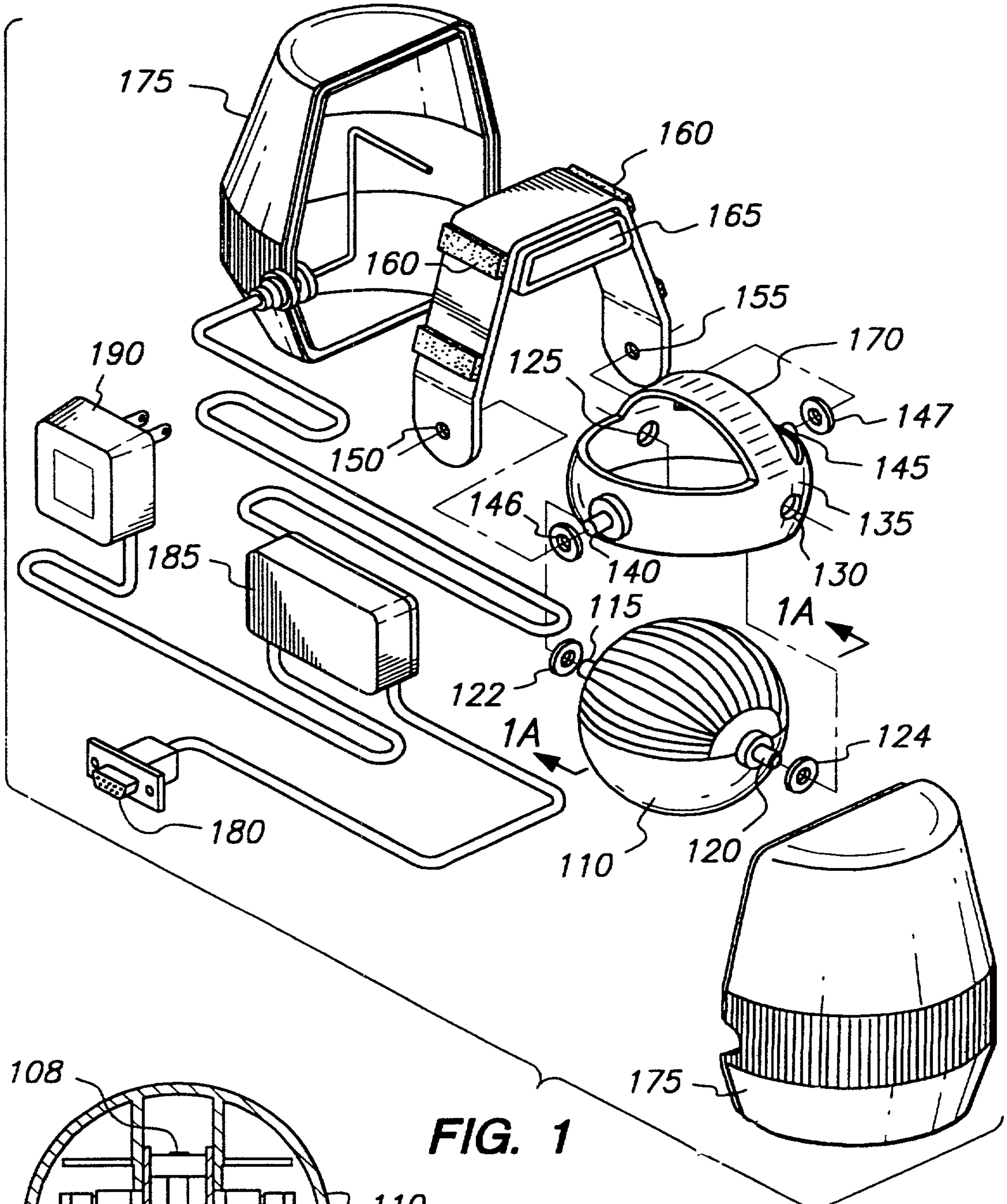

FIG. 1

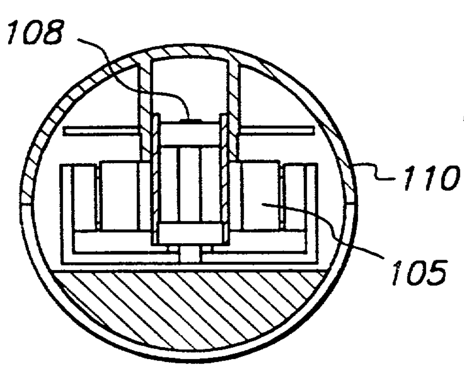

FIG. 1A
(SECTION A–A)

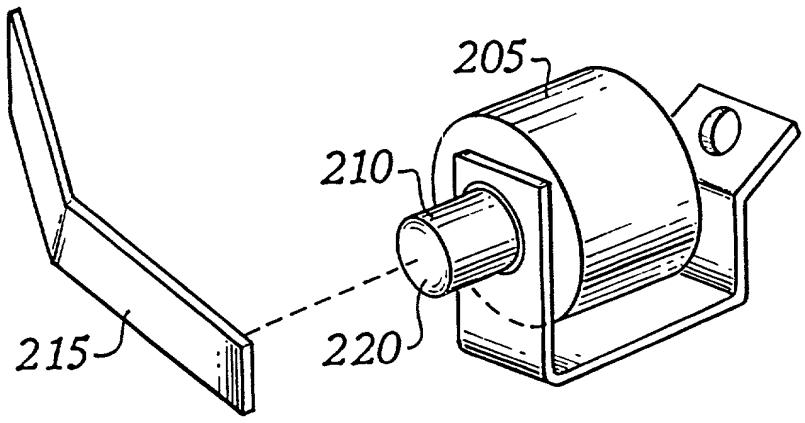

Figure 2

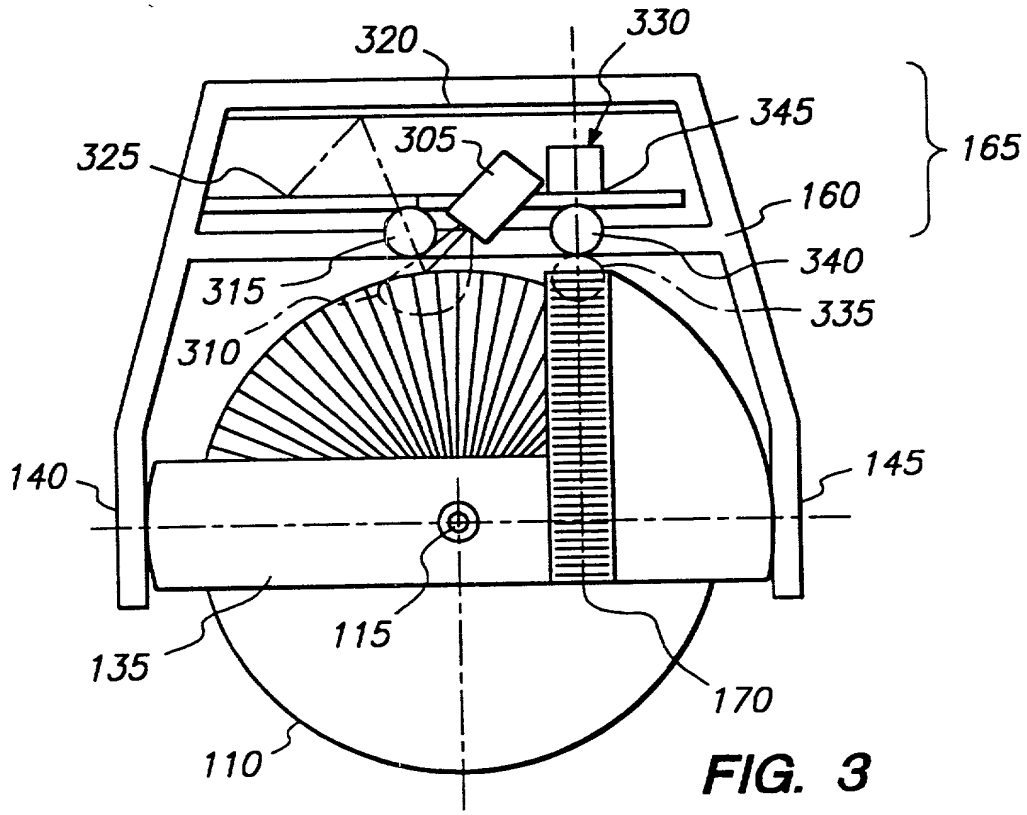
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FIG. 3

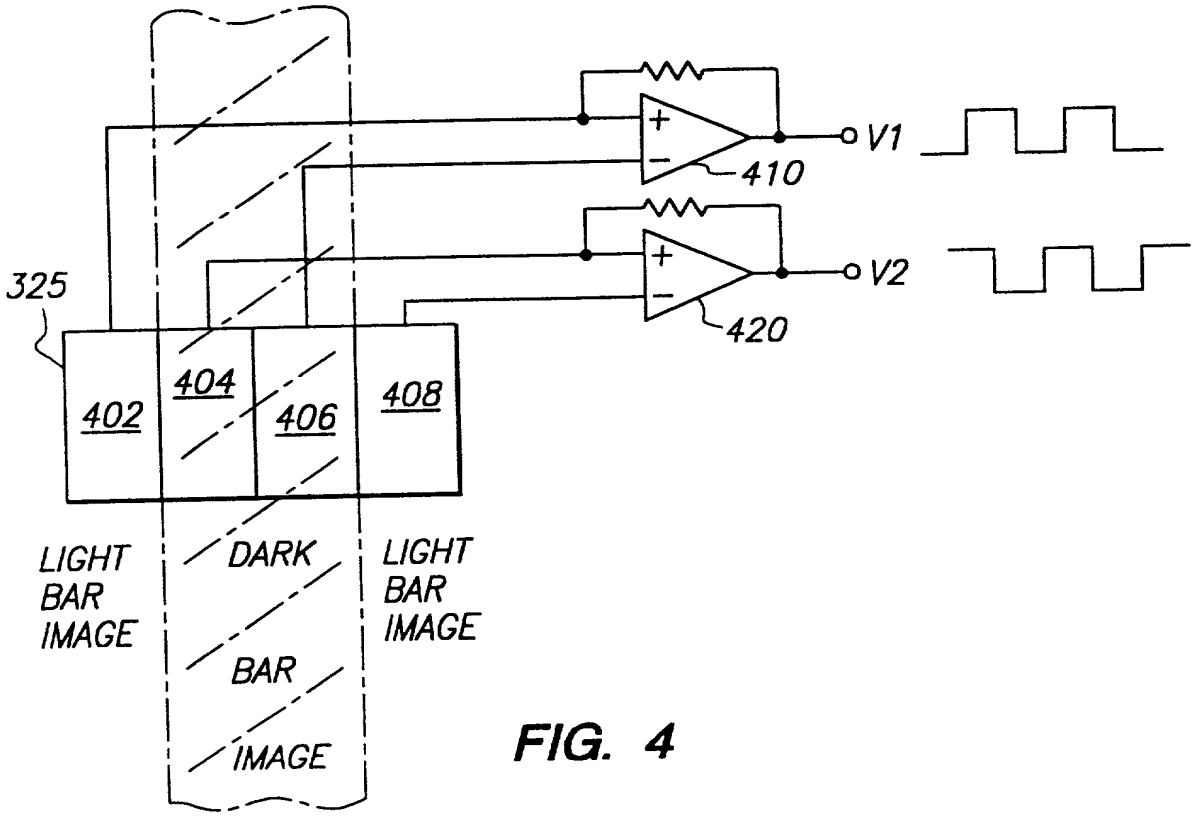
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FIG. 4

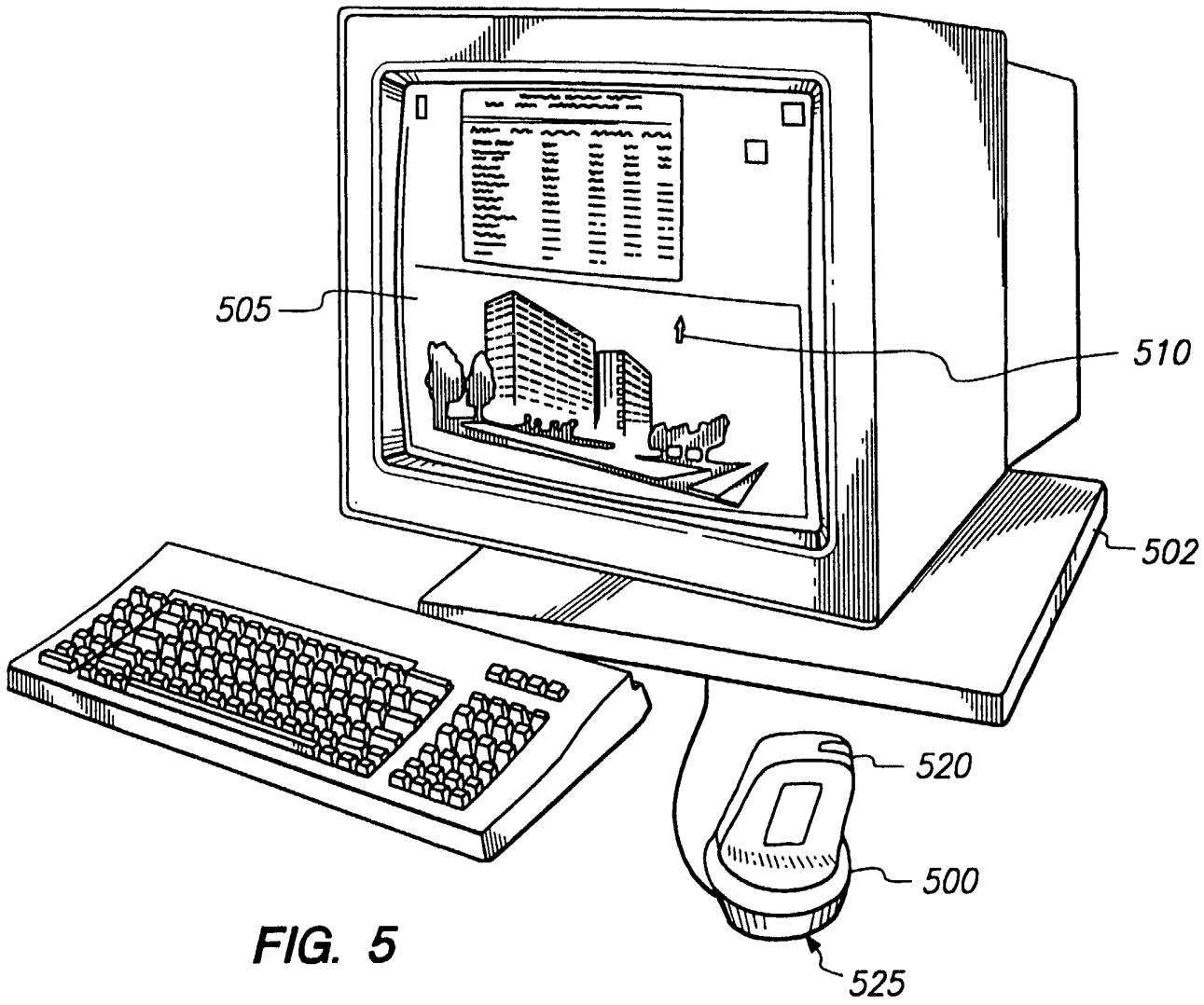

FIG. 5

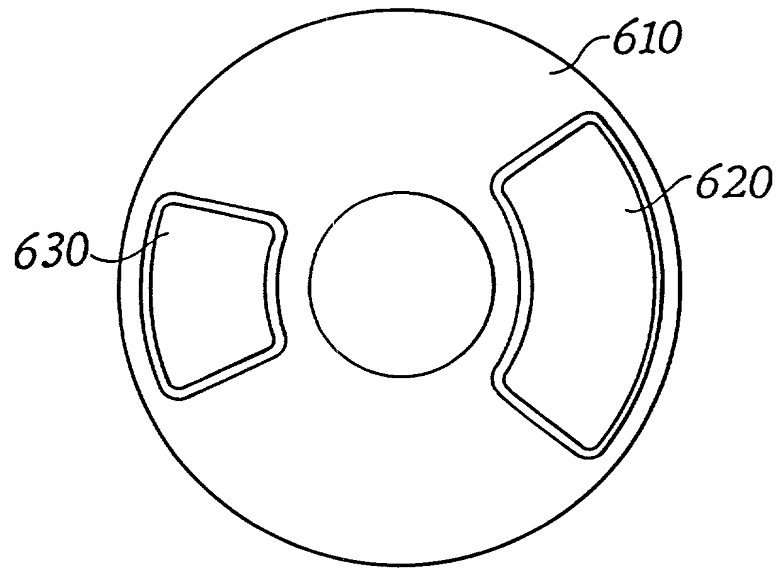

Figure 6

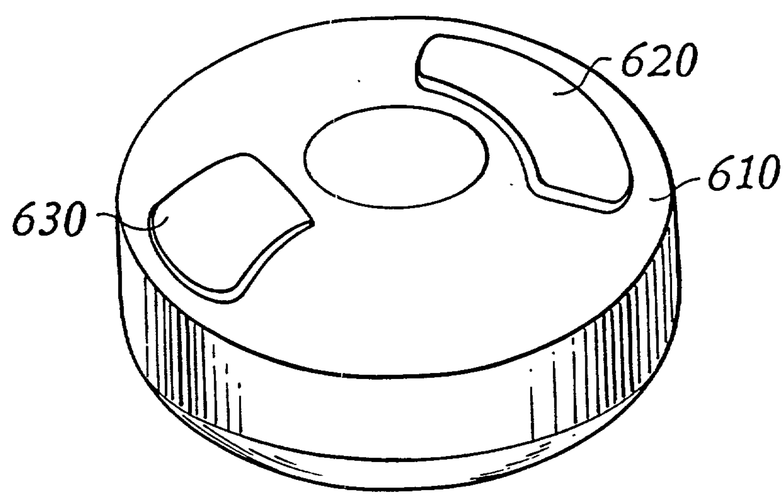

Figure 7

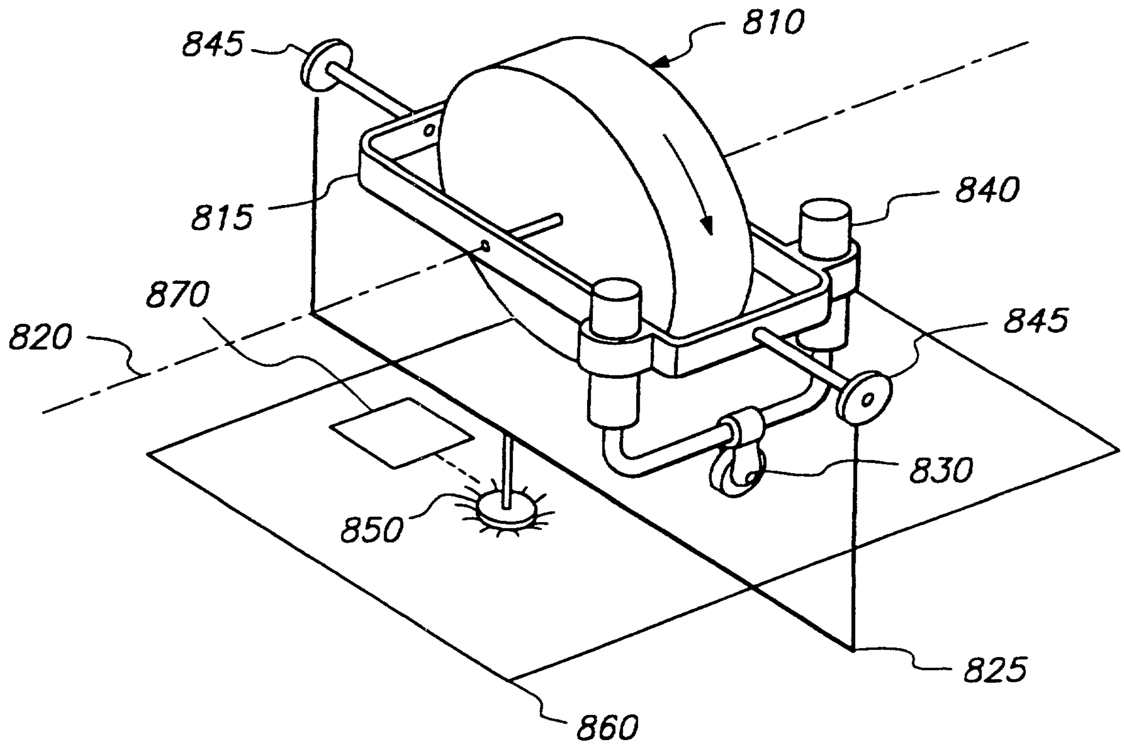

FIG. 8

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SUPPLEMENTAL DECLARATION FOR REISSUE PATENT APPLICATION TO CORRECT "ERRORS" STATEMENT (37 CFR 1.175)

Attorney Docket Number	5167
First Named Inventor	Thomas J. Quinn
COMPLETE	
Application Number	09 / 642,250
Filing Date	08/17/2000
Group Art Unit	Unassigned
Examiner Name	Unassigned

I/We hereby declare that:

Every error in the patent which was corrected in the present reissue application, and which is not covered by the prior oath(s) and/or declaration(s) submitted in this application, arose without any deceptive intention on the part of the applicant.

I/We hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
Thomas J.	Quinn

Inventor's Signature: [signature] Date: 9/28/00

Name of Second Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname

Inventor's Signature: Date:

Name of Third Inventor: ☐ A petition has been filed for this unsigned inventor

Give Name (first and middle [if any])	Family Name or Surname

Inventor's Signature: Date:

Name of Fourth Inventor: ☐ A petition has been filed for this unsigned inventor

Give Name (first and middle [if any])	Family Name or Surname

Inventor's Signature: Date:

☐ Additional inventors are being named on the _____supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.

PTO/SB/51 (12-97)
Approved for use through 9/30/00. OMB 0651-0033
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Docket Number (Optional) 5167

REISSUE APPLICATION DECLARATION BY THE INVENTOR

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is described and claimed in patent number 5,898,421, granted April 27, 1999, and for which a reissue patent is sought on the invention entitled Gyroscopic Pointer and Method,
the specification of which

[X] is attached hereto.

[ ] was filed on _____ as reissue application number ___ / _____
and was amended on _____ .
(If applicable)

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.
I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.
I verily believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below. (Check all boxes that apply.)

[ ] by reason of a defective specification or drawing.

[X] by reason of the patentee claiming more or less than he had the right to claim in the patent.

[ ] by reason of other errors.

At least one error upon which reissue is based is described as follows:

Applicant intended to claim all disclosed embodiments of the invention contained in the application as originally filed, including embodiments of a system operable with an input device comprising an inertial element for translating a displayable object in response to rotation of the input device, but did not adequately communicate his intentions to his attorneys of record in order to attain the scope of claims coverage to which he believes he is entitled.

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Approved for use through 9/30/00. OMB 0651-0033
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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(REISSUE APPLICATION DECLARATION BY THE INVENTOR, page 2)

Docket Number (Optional): 5167

All errors corrected in this reissue application arose without any deceptive intention on the part of the applicant. As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Name(s)	Registration Number
Albert C. Smith	20,355

Correspondence Address: Direct all communications about the application to:

☐ Customer Number _____ *Type Customer Number here*

OR

Place Customer Number Bar Code Label here

☒ Firm or Individual Name	Fenwick & West, LLP				
Address	Two Palo Alto Square				
Address					
City	Palo Alto	State	CA	ZIP	94306
Country	U.S.A.				
Telephone	650-858-7296	Fax	650-494-1417		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this declaration is directed.

Full name of sole or first inventor (given name, family name): Thomas J. Quinn

Inventor's signature: TJQ

Residence	Date
Los Gatos, California	7-14-00
Post Office Address	**Citizenship**
5760 Harwood Ct., Los Gatos, CA 95032	U.S.A.

Full name of second joint inventor (given name, family name)

Inventor's signature	Date
Residence	Citizenship
Post Office Address	

Full name of third joint inventor (given name, family name)

Inventor's signature	Date
Residence	Citizenship
Post Office Address	

☐ Additional joint inventors are named on separately numbered sheets attached hereto.

PTO/SB/54 (12-97)
Approved for use through 9/30/00. OMB 0651-0033
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

REISSUE APPLICATION BY THE ASSIGNEE, OFFER TO SURRENDER PATENT

Docket Number (Optional)
5167

This is part of the application for a reissue patent based on the original patent identified below.

Name of Patentee(s):
Thomas J. Quinn

Patent Number	Date Patent Issued
5,898,421	April 27, 1999

Title of Invention
GYROSCOPIC POINTER AND METHOD

Gyration, Inc. is the assignee of the entire interest in the original patent.

I offer to surrender the original patent.

[X] A certificate under 37 CFR 3.73(b) is attached.

I am authorized to act on behalf of the assignee.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application, any patent issued thereon, or any patent to which this declaration is directed.

Name of assignee
Gyration, Inc.

Signature of person signing for assignee	Date
TJQ	7-14-00

Typed or printed name and title of person signing for assignee
Thomas J. Quinn

Atty. Dkt. No.: 5167

Certificate Under 37 CFR § 3.73(b)

Applicant: Thomas J. Quinn

Application No.:

Filing Date: July 21, 2000

Name of Assignee: Gyration

Type of Assignee (e.g. corporation, partnership, university, government agency, etc.): Corporation

The above-mentioned Assignee certifies that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of either:

A. ☑ An assignment from the inventor(s) of the patent application identified above. The assignment was recorded in the Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached; OR

B. ☐ A chain of title from the inventor(s), of the patent application identified above, to the current assignee as shown below:

1. From: _____
   To: _____
   The document was recorded in the Patent and Trademark Office at
   Reel: _____ and Frame: _____, or for which a copy thereof is attached.

2. From: _____
   To: _____
   The document was recorded in the Patent and Trademark Office at
   Reel: _____ and Frame: _____, or for which a copy thereof is attached.

3. From: _____
   To: _____
   The document was recorded in the Patent and Trademark Office at
   Reel: _____ and Frame: _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☐ Copies of assignments or other documents in the chain of title are attached.

The undersigned has reviewed all the documents in the chain of title of the patent application identified above and, to the best of undersigned's knowledge and belief, title is in the assignee identified above.

The undersigned (whose title is supplied below) is empowered to sign this certificate on behalf of the assignee.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements, and the like so made, are punishable by fine or imprisonment, or both, under Section 1001, Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

8/17/2000
Date

Q. C. Smith
Signature

Name

Title

PATENT

COPY

CONFIRMATORY ASSIGNMENT

For good and valuable consideration, receipt of which is hereby acknowledged, Thomas J. Quinn ("ASSIGNOR", herein) has assigned and transferred and does hereby assign and transfer to Gyration, Inc., a California corporation having a place of business at 12930 Saratoga Avenue, Saratoga, CA 95070 ("ASSIGNEE", herein) the entire right, title and interest in and to the following identified Letters Patent and Applications for Letters Patent of the United States:

Patent No.:	Title:	Issue Date:
5,440,326	Gyroscopic Pointer	08/08/95
5,898,421	Gyroscopic Pointer	04/27/99

Application No.:	Title:	Filing Date:
07/497,127	Gyroscopic Pointer	03/21/90
08/406,727	Gyroscopic Pointer	03/20/95

and in and to any and all applications for patent and patents therefor in any and all countries, including all divisionals, reissues, continuations, continuations-in-part, and extensions thereof, and in all inventions set forth and described therein, together with all rights of priority resulting from the filing in the United States of said Applications and the respective applications for said United States Letters Patents identified above, and the right to sue in its own name and to recover for past infringement of any of said Letters Patent, and the Assignor agrees that on request and without further consideration, but at the expense of the Assignee, the Assignor will communicate to the Assignee or its representatives or nominees any facts known to the Assignor respecting said United States Letters Patents and Applications and the inventions set forth therein, and will testify in any legal proceeding, sign all lawful documents, execute all divisional, continuing and reissue applications, make all rightful oaths or declaration and generally do everything possible to aid the Assignee, its successors, assigns and nominees to obtain, maintain, and enforce patent protection in all countries for the inventions

set forth in said United States Letters Patents and Applications for Letters Patents identified above and in all foreign counterparts thereof.

Signed and sealed this August day of 8, 2000.

Thomas J. Quinn

State of ____________________}
County of __________________} ss

On this ______ day of ________________, 2000, before me, __________ __________________, a Notary Public in and for the State of _________________, personally appeared ___________________________________, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s) or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

____
Notary Public